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## An Empirical Test of the Market Relaxation - State Compression Hypothesis

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**AN EMPIRICAL TEST OF THE MARKET RELAXATION -  
STATE COMPRESSION HYPOTHESIS**

**By**

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**July 1995**

**An Empirical Test of the Market Relaxation - State  
Compression Hypothesis**

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# **An Empirical Test of The Market Relaxation - State Compression Hypothesis**

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Christopher B. Barrett\*

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## **Introduction**

A central aim of agricultural liberalization efforts in African countries has been to improve farmers' incentives so as to stimulate productivity and growth. But policymakers have little if any direct economic contact with farmers. Rather, if policy reforms are to influence individuals' behavior through changes to price incentives, then markets must transmit intended, stimulative signals throughout the economy. Yet market conditions are endogenous to the liberalization process. In particular, the extent to which spatially and temporally distinct markets are integrated can change sharply with fundamental policy reforms. This paper empirically tests these effects, examining how liberalization efforts in the 1980s affected spatial and temporal food market integration in Madagascar.

What is market integration? In the space domain, if a shock to the price of a commodity in one market due to purely local demand or supply perturbations becomes manifest in another market's price, then the two are said to be "integrated." This is closely to the concept of "tradability," as commonly applied to international trade. In contrast, if shocks to one market's price are never felt in another market, the two are proclaimed not integrated, or "segmented," with obvious implications of nontradability. If two markets are perfectly integrated with respect to a particular commodity, there

should be a one-to-one correspondence between the two price series, while if they are perfectly segmented, their price series should be statistically independent. In the time domain, the concept of tradability implies an intertemporal arbitrage condition: that the rate at which prices increase over time equals the ratio of the real interest rate to the depreciation (loss) rate, appropriately adjusted for risk effects.<sup>1</sup> Analogously, substantial deviations from the intertemporal arbitrage condition imply market segmentation across time periods.

The notion of market integration thus really concerns the free flow of goods and information — which together determine prices— over space and time. Hence its close relationship to concepts of efficiency. Government interference often impedes such flows, thereby inducing inefficiencies. Hence one motivation for market liberalization. Moreover, the efficacy of policy measures that rely on changing (relative) prices to induce behavioral change depends fundamentally on the strength of transmission of market price signals across space and over time. If markets are not integrated spatially, the cross-sectional aggregation of demand and supply that is central to sectoral and macroeconomic analysis loses its logical foundation, and state-initiated signals may have little or no effect on local prices and behaviors. Similarly, if markets are not seasonally integrated, intertemporal aggregation of demand and supply becomes artificial, and seasonal cycles in income and prices become especially important determinants of consumption and production behaviors.

Simply put, segmented markets demand more costly, disaggregated analysis. Moreover, segmented markets are more likely to require relaxation of the convenient assumption of perfectly competitive markets, if only because smaller markets are more susceptible to the emergence of natural monopolies due to the minimum efficient scale of intermediation (*e.g.*, transport, bulk storage) technologies. As recent developments in macroeconomic and trade theory vividly demonstrate, a break from the standard assumption of perfectly competitive markets can have monumental impacts on model results and policy implications.

There is long-standing and widespread observation of serious infrastructural obstacles — of both the physical and institutional sorts — to market interlinkages and efficient agricultural price transmission in African rural markets. For instance, the World Bank's [1989] long-term perspective study on African development states that "improving rural infrastructure is an essential requirement for the modernization and growth of agriculture. Better market incentives to farmers will be blunted if the physical barriers and economic costs of transporting goods to and from local markets are too high" [p.103].

Heavy-handed state interventions in the pricing, interregional movement and interseasonal storage of agricultural commodities have drawn equally long and critical attention as impediments to more efficient marketing. State agricultural marketing boards often become illiquid or run out of sacks, vehicles or storage capacity.

Consequently, the spatial and temporal extent of state activities has often been limited and inappropriate, forcing many consumers and producers onto an illegal parallel market. In the opinion of Harriss [1979a, p.371], state interventions in Africa "induce spatial compartmentalization" despite the common rhetoric of panterritorial and panseasonal integration and equity. Government authority often exceeds the limits of both its technical competence and its agents' self-restraint, leading to inconsistent application of administrative pricing and distribution rules, and widespread rent-seeking. "Chronic problems of dis-coordination and discretionary decision-making play into the hands of large private traders (who may also be bureaucrats)" [Harriss 1979a, p.371]. Meanwhile, the efficiency of the parallel, private market is often low. Widespread government restrictions on private marketing activities dampen trade and generally force traders to parcelize activities so as to avoid detection, at the expense of higher unit transfer costs due to considerable risk premia and volumes suboptimal for the technologies involved. In summary, state intervention and corruption often facilitate the emergence and consolidation of private monopolies and the disintegration of comprehensive national distribution networks, exacerbating the very problems market regulation is supposed to alleviate.

The issues of poor infrastructure and governance are also related. In many African nations, the publicly developed marketing infrastructure was ill-suited to inter-regional trade, as distinct from evacuation of export crops to port, in both the colonial and

post-independence periods. More generally, poor delivery of services, due often to incoherent provision of infrastructure and inadequate maintenance, has often impeded the emergence of efficient, responsive trading networks.

In the ideal world, economic reforms can simultaneously tackle both governance and infrastructure problems, and in a few settings it seems they have.<sup>2</sup> But in much of Africa agricultural liberalization efforts have addressed only failed government interventions in agricultural marketing, not the substantial bottlenecks created by insufficient and low-quality infrastructure. This has had adverse consequences for agricultural supply response, as World Bank analysts acknowledge: "recent experience indicates that supply response of structural adjustment operations has been stifled by rural transport deficiencies" [Riverson, Gaviria and Thurscott 1991, p.ix]. Some commentators even argue that the fiscal retrenchment synonymous with liberalization has exacerbated infrastructural problems [Longhurst 1987; Mosley and Smith 1989], which leads to an intriguing hypothesis.

### **Market Relaxation and State Compression**

Michael Lipton [1990, 1991] has perhaps most clearly conceptualized the potential tension inherent in contemporary efforts to improve market performance in Africa. Lipton characterizes liberalization as consisting of two distinct, countervailing impulses. The first, market relaxation, loosens or eliminates state restrictions on private

sector activity.<sup>3</sup> The movement away from controlled pricing and physical movement of commodities tends to open up space for private intermediaries to operate freely, openly and competitively, with potentially positive consequences for smallholders' welfare, agricultural production and marketing volumes, and the economy as a whole.

Meanwhile, however, the bias in most structural adjustment operations toward minimizing the state's role in the economy,<sup>4</sup> which Lipton labels "state compression", can generate opposing effects that might choke off nascent competition and efficiency gains. State compression has four dimensions. First, reduced expenditure on public goods infrastructure and services (*e.g.*, maintenance of roads, and bridges, extension services, phytosanitary controls, rural policing) forces private industry to bear more of these costs alone. This naturally leads to socially suboptimal supply. Increasing undersupply can undo the good work done by market relaxation if, for example, roads become impassable or marketable production suffers from preventable epidemiological disasters.

Second, sharp real reductions in government salaries increase local authorities' propensity to extort bribes and otherwise obstruct liberalization efforts.<sup>5</sup> There have been noteworthy rearguard actions by bureaucrats and local government functionaries to impede liberalization in several African nations, including Madagascar. Even though central governments declare trade free everywhere, some local authorities have introduced their own restrictions, sometimes in the name of local food security, but often blatantly to bolster declining real government salaries or to maintain incumbents' market

or neopatrimonial political power [Barrett 1994a, Berg 1989, Coulter 1994].

Third, restrictive monetary policy and tightened banking prudential oversight practices explicitly seek to increase real interest rates and improve the solvency of financial institutions, with an eye toward expanding the deposit base of the national banking system. But by making credit more expensive, and often less accessible for private marketing intermediaries in rural areas, these tendencies can inhibit entry and restrict the capacity of intermediaries to invest in capital equipment (*e.g.*, trucks, silos, electrical mills) for long-term efficiency gains, or even in commodity inventories for interseasonal arbitrage. Panseasonal pricing, even where relatively ineffective, created disincentives to investment in and maintenance of bulk storage capacity. One legacy of the *dirigiste* era is thus widespread shortage of private, commercial bulk storage facilities, thereby inhibiting interseasonal arbitrage. Thin markets contribute to price volatility, which discourages prudent lending and investment in the presence of sunk costs, which thin markets further. A vicious cycle easily begins. With parastatals no longer stockpiling large quantities of basic foodgrains and few private merchants holding more than transactional stocks, many observers maintain that most interseasonal storage is now carried out by farmers themselves [Christiansen and Stackhouse 1989; Coulter and Golob 1992; Coulter 1994]. However, with rudimentary storage technologies, physical loss rates can be substantial, in many cases much larger than when state marketing boards managed stocks poorly in excessively modern and urban facilities.

Finally, for all their drawbacks, state marketing boards did provide some services that must be replaced, perhaps even extended, in the wake of state withdrawal from agricultural marketing. Publicly declared prices often provided the only baseline market price information service, reaching at least those regions where parastatals were active. The need for market price information services has been emphasized by Coulter [1994], Staatz, Dioné and Dembélé [1989] and Jones [1972], among others, but has only recently found acceptance among governments and donors despite the relatively low cost of service provision. Credit for farmers' purchase of modern inputs, and even for hungry season consumption goods, was often extended as an advance against cash receipts from later produce sales when the state had a working monopsony. Where liberalization has opened up competition in farm-level crop purchasing, it has sometimes, as in parts of Madagascar, Senegal and Zaire, also had the unfortunate effect of discouraging seasonal credit [Thomas and Reintsma 1989; Thompson 1991; Barrett 1994b]. For reasons described above, the financial sector is often unable to pick up the slack left by parastatals' retreat. Finally, pre-liberalization informal trading tended to be based more on personal relationships within which informal contract enforcement mechanisms exist. The depersonalization of exchange relations inherent in freed markets extends marketing intermediaries' commercial reach without necessarily simultaneously extending the extra-legal protection of contracts [Platteau 1994a, 1994b]. Parastatals had the dubious benefit of state power behind them to help enforce marketing contracts.<sup>6</sup>



In summary, if African agricultural market liberalization is aimed at facilitating private trade so as to enhance market integration and harness the Walrasian efficiency of free market pricing, such reforms likely demand not just the diminution of state restrictions on private sector activity, but equally the rehabilitation, maintenance and extension of supporting infrastructure and services through complementary investments [Barrett and Carter 1994; Staatz *et al.* 1993; Yao and Hay 1991]. The need is to build up competitive marketing channels where they were long suppressed. Where *ex ante* state controls were effective and injurious, aggressive dismantling of parastatal structures may be central to attainment of that goal. In other cases, including where state controls were relatively ineffective, state compression may be a subordinate concern to issues of infrastructure and finance for, as Yao and Hay [1991, p.86] put it, "the assumption that mechanisms for state intervention can be dismantled quickly because private traders will be willing and able to move into vacated markets is not substantiated by experience."<sup>7</sup>

### **Markets and Liberalization in Madagascar**

Madagascar provides a useful setting to explore these claims empirically. State involvement in food marketing, which was considerable but varied in efficacy across regions and commodities, diminished sharply in the latter half of the 1980s, but provision of public goods and services generally did not expand (indeed probably diminished in most locations) with liberalization. Examination of how liberalization affected spatial

and intertemporal market integration, taking care to control appropriately for the ex ante conditions of commodity- and region-specific markets, offers an enlightening empirical test of the market relaxation - state compression hypothesis.

From 1973 the Malagasy government enforced a legal monopsony in the purchase of rice, manioc, maize and dried beans (as well as several commodities not considered here), and a monopoly in the distribution, processing and commercial storage of those commodities. The state's hold on these markets varied across regions, time and commodities. With respect to rice, the principal crop, AIRD [1984] estimated official purchases at 10-20 percent of domestic paddy production. With the marketed proportion of production generally believed to be about one-quarter, the official marketing channel probably controlled half or more of marketed rice, quite a high figure. An enforcement agency, the *Brigade Mixte d'Intervention Economique* (BMIE), seized illegal stocks, usually of rice, and arrested those caught or suspected of trading illegally. The BMIE's operations, as well as those of the state marketing boards, were concentrated in the regions around the five principal cities (Antananarivo, Antsirabe, Fianarantsoa, Mahajanga, and Toamasina)<sup>8</sup> and the main rice producing region (Ambatondrazaka). If market relaxation enhances intertemporal or spatial market integration, one would expect measurable improvements where government controls were strongest and only weak effects, if any, where government exercised little control.

State restrictions over food marketing were wholly eliminated over the span of a

few years in the mid-1980s. Domestic and international trade in foods was fully opened to competition, government price controls and consumer subsidies were loosened then eliminated, and several of the larger public agricultural enterprises were disbanded or privatized. International observers such as the IMF, World Bank and USAID celebrated the breadth and depth of Madagascar's market-oriented reforms [Barrett 1994a].

Yet while state interventions in agricultural marketing receded markedly, the Malagasy state has continuously neglected rural infrastructure over the past two decades, as detailed below. With the exception of only a few enclaves, there has been no significant infrastructural improvement to accompany state withdrawal from agricultural marketing. If the market relaxation-state compression hypothesis is true — that state compression can choke off nascent gains from market relaxation — one would expect to see little if any improvement in market integration indicators among those regions where infrastructure has been and remains underdeveloped.

### **Spatial Market Integration**

We can test the market relaxation-state compression hypotheses, as well as get a strong indication of the degree to which price shocks are transmitted across spatially distinct geographical markets, by considering the effects of liberalization measures on market integration. Unfortunately, there are no compelling methods available for such testing [Harriss 1979b; McNew 1994; Barrett forthcoming], so I rely on simple

techniques applied to monthly retail food price data from each of Madagascar's 17 agricultural enumeration areas.<sup>9</sup> Common inflationary and seasonal trends in the regional price data were removed from the data by deflating the nominal data by the national consumer price index, then deseasonalizing using the ratio-to-moving-average method.<sup>10</sup> This cleaning renders the data stationary, so all the series are trivially cointegrated, eliminating that increasingly popular method and Ravallion's [1986] error-correction mechanism specification as testing options. Consequently, bivariate correlation coefficients among the deflated, deseasonalized price series form the basis for the present analysis. These correlations are computed both on the price levels and on their first differences, so as to adjust for autocorrelation.<sup>11</sup>

The regional price series for each commodity were divided into two groups accordingly to *ex ante* market conditions: seven (more urban) regions where the state's marketing presence was pronounced and infrastructure is relatively good,<sup>12</sup> and ten regions where the state's marketing presence was never as pervasive and the infrastructure was and remains relatively poor. The analysis that follows addresses three distinct questions concerning spatial market integration: (1) how strong are intermarket prices linkages? This offers a good indicator of the extent of the central government's influence through price-based policy measures. (2) Have liberalization measures improved market integration? Finally, (3), have the effects of liberalization differed between the "primary regions", where state control had been significant and infrastructure

is functional, and the "secondary regions", where state control was much weaker and infrastructure was and remains quite decrepit?

Table 1 presents the proportions of sample correlation coefficients between regional price levels that were statistically significantly greater than zero ("minimally integrated") pre- and post-liberalization, that were greater than 0.7<sup>13</sup> ("reasonably well integrated") pre- and post-liberalization, and that experienced statistically significant changes with liberalization, either negative or positive. These results are reported in three panels: market integration within primary regions, between primary and secondary regions, then within secondary regions. Several findings are immediately apparent.

First, other than for rice, most of the market pairs were not even minimally integrated before liberalization, while considerably more were after liberalization. Except for manioc, all the primary region market pairs were minimally integrated for each crop post-liberalization, and at least 80 percent were minimally integrated with secondary region markets as well. This would appear to suggest liberalization brought at least minimal, broadly-based interconnectedness. Within secondary regions, the proportion of minimally integrated markets was unambiguously lower post-liberalization than within primary regions, indicating that infrastructural obstacles in more remote regions remained a serious impediment to marketing efficiency.

Statistical tests for a structural change in correlation coefficients also showed positive improvements in a substantial number of series linked to primary regions. Note,

however, that the secondary regions consistently have a lower proportion of market pairs showing positive structural shifts than do the primary regions; indeed, many evince market disintegration. As hypothesized, liberalization's positive, market relaxation impacts appear to have been most concentrated where the state's influence, *ex ante*, and the quality and density of infrastructure, *ex post*, were greatest. The proportions of correlation coefficients exceeding 0.70 likewise suggest an important jump in market integration among primary region markets, but much less so among secondary region markets. The law of one price seems to apply only to a spatial subset of Malagasy food markets. Moreover, with the exception of rice and dried beans within the primary region markets, less than half of the market pairs are reasonably well integrated (defined as  $r > 0.70$ ), and only ten percent of the market pairs within secondary region markets are reasonably well integrated. From these results it would seem that liberalization had mildly positive, commodity- and, especially, regionally-differentiated effects on market integration, but that domestic food markets remain only weakly integrated with one another, substantially limiting the capacity of central government price policy to influence the incentives faced by farmers in the hinterland.

One concern regarding the correlations underlying Table 1 is that parallel econometric work [Barrett 1994c] indicates that the autocorrelation of the univariate food price series jumped markedly with liberalization. Autocorrelation inflates the estimated correlation coefficients, so the sample statistics presented in Table 1 are likely upper

bounds on the true population correlations. One simple way to address this problem is to correlate the first differences of the regional price series [Stigler and Sherwin 1985]. One is then explicitly measuring the extent to which price shocks in one market are contemporaneously felt in the other market. Of course, since the series were already stationary, this method "over-differences" the data, so the corresponding figures likely present lower bound estimates to juxtapose the upper bound estimates in Table 1.

Table 2 replicates the statistics of Table 1, now for correlations among first-differenced series. The story changes noticeably. Now liberalization still seems to have net positive, but quite limited effects. No more than one-fifth of the market pairs for any commodity were minimally integrated prior to liberalization, and the proportion improves only moderately, to a maximum of 67 percent (for rice within the primary regions) with liberalization. Within the primary region, there is noticeable (if rarely statistically significant) improvement in minimal market integration. But in the secondary regions the proportion of minimally integrated market pairs falls for two commodities and is unchanged for the other two. The proportion of statistically significant structural changes in correlation coefficients is quite small for all commodities and regions. Perhaps most significantly, no market pairs' first-differenced prices exhibit a correlation coefficient exceeding 0.70 in either period. These lower bound estimates suggest minimal impacts from liberalization, with perhaps some positive impacts in primary regions largely offset by market disintegration in secondary regions. These figures thus tell a less positive

story than those of Table 1, suggesting that liberalization was rather ineffective in improving intermarket price efficiency, and, consequently, that government price policy is unlikely to be a very effective tool for eliciting desired production, consumption or marketing responses in the market environment of contemporary Madagascar. Between the two bounding sets of estimates, the general impression is that spatial market integration improved substantially more in the primary regions than in the secondary ones, but remains sharply limited in both.

### **Continuing Obstacles To Food Market Integration**

The market for dried beans provides an interesting demonstration of the difficulty of reversing state takeover of a marketing channel.<sup>14</sup> The bean market was completely free, and characterized by vertically integrated private trading operations (from farmgate collection through urban distribution) until the state vested itself with legal monopoly powers in bean marketing in 1973. Some existing bean traders became collectors for the state societies, but most appear to have left the market entirely. From about 1986, officially free competition returned. But in the meantime, both rural infrastructure and security had degraded. Without established interregional correspondent networks, and faced with significant costs and risks to operating outside their own locale, bean traders have become quite localized, with just a few very large wholesalers making the rural-urban linkages. Wholesalers are reluctant to extend cash advances to collectors, both due



to a lack of repayment enforcement mechanisms and to rural insecurity in the principal bean-growing areas of the western highlands. So while private trade has recovered, it is now far more fractured, with greater transactions costs, than before nationalization. The period of parastatal control has had a lasting impact on the way markets organize presently, with significant consequences for price transmission and trading efficiency.

Liberalization brought an end to a quantity-rationed state distribution network and the resulting composite market system that had prevailed for the preceding decade or so. There now appears to be increased competition at the collection, processing and retailing levels of the food marketing chains, and the marketing network extends further into the countryside than it had previously [Abt Associates 1991; World Bank 1991a; my unpublished data]. But there is little evidence of increased competition in regions where transport and communications infrastructure remain substantially inoperative, nor at the wholesaler level, at which most interregional trade and interseasonal commercial storage takes place in Madagascar [Abt Associates 1991].

Continued inefficient government control over fuel distribution has led to widespread shortages of diesel in rural areas (and of gasoline in urban ones). Meanwhile regular shortages of foreign exchange have shrunk the supply of vehicles and spare parts. Government activity thus continues to hamper transport.

Moreover, in many areas local governments continue to enforce restrictions on the physical movement and pricing of food commodities. Berg [1989, p.727] reports

"propensities to stifle competition are strong and widespread, emanating especially from the trading and rice producing parastatals and local officials," and recounts stories of road closings by FIFABE officials in the Maravoay basin during the 1985 harvest and collusion among officials in the Lac Alaotra area in the year immediately following the termination of SOMALAC's legal monopoly. Azam *et al.* [1993] report similar stories from the far west and north, and Abt Associates [1991] offer further anecdotes. It has clearly been difficult to transition to a free market system.

Roads remain a serious problem to food marketing and thus to price transmittal and elicitation of a sustainable agricultural supply response.<sup>15</sup> Bad roads inhibit the evacuation of agricultural commodities, especially from more remote areas, and impede the timely delivery of modern inputs and incentive consumer goods. Poor roads also facilitate the oligopsonistic organization of collection,<sup>16</sup> which dampens supply responsiveness by depressing farmers' returns. Szal [1988, p.749] claims that "producer prices play less of a motivational role in production decisions than the lack of inputs and poor transport," and that this contention is supported by regression analysis. The World Bank [1991b, p.2] states bluntly that "the overall condition of rural roads remains dismal. At present, about 90 percent of the estimated 40,000 kilometers are in bad to fair condition." UNDP/MEP [1991] estimated that less than one percent of all roads are asphalted (declining from 1.7 percent in the Highlands to 0.2 percent in the far north and south). Pryor [1990] could find no evidence of a comprehensive government

transportation plan because "according to the Director of the Planning Office, the government 'forgot' to provide normal funds for road maintenance" [p.322].

Where the government has more recently attempted to consolidate and improve the rural roads network, it has often met with fierce resistance from local governments, for two main reasons. First, banditry (*dahalo*) is widely believed to have increased substantially in the 1980s,<sup>17</sup> and many fokontany leadership councils express a belief that better roads will only make their villages less defensible.<sup>18</sup> Second, poor infrastructure protects the profitable oligopsony/oligopoly positions of many local elites by impeding entry by outsiders [Barrett 1994a]. There are thus incentives at the local government level to avoid rehabilitation and maintenance of roads that might improve producer incentives and market integration.

It is not just the infrastructure that is in bad shape. Berthélemy [1988], citing Ministry of Transport data, reports that the average age of the stock of road haulage equipment was greater than ten years, and half was out of commission in the mid-1980s. The disincentives created by panterritorial official pricing and foreign exchange rationing during the 1970s and early 1980s effectively choked off replacement—much less expansion—of Madagascar's rolling stock in the pre-liberalization era. The legacy bequeathed to the post-reform era is one of transport bottlenecks that inhibit competition and trade. Vehicle operating costs on poorly maintained roads are almost half again as much as on good ones [Barrett 1994b]. Moreover, poor roads routinely become

impassable, especially in the rainy season, requiring evacuation by draught animal or headloading, at two to ten times the cost of motorized transport, respectively [Abt Associates 1991; World Bank 1991b]. The World Bank [1991b] concludes that

"the rural roads sub-sector ... has not been affected by the policy reform efforts. The poor condition of roads still requires emphasis on complete rehabilitation. On-going projects, although allocating a substantial amount of resources, are proceeding independently outside a rational framework for intervention. As a result, the roads rehabilitated under several on-going rural road projects have little prospects of receiving any maintenance" [p.5]

In light of these substantial, continuing infrastructural and institutional obstacles, it is perhaps unsurprising that Madagascar's food markets appear only weakly integrated overall, with quite economically isolated enclaves. The capacity of government policies to affect prices in a predictable, stimulative manner cannot be great under such circumstances, with a distinctly limited effective geographic range.

### **Intertemporal Market Integration**

Matters are no better when one considers the effects of liberalization on interseasonal price variability. Azam et al. [1993] and the World Bank [1991a] report substantial seasonal price increases, apparently well in excess of borrowing and storage costs estimated at from 20-40 percent. They attribute this chiefly to insufficient credit available to traders. The World Bank [1991a] estimates that rice obtains more than 80 percent of all agricultural trading credit. Even so, less than 25 percent of marketed rice is

financed by bank credits, with almost 90 percent of the credit going to just three geographic regions. Credit controls imposed by the Central Bank — especially on BTM, the commercial bank with the broadest network — have seriously impinged on borrowing by rural marketing agents. This has important implications for interseasonal storage and price stability. Most large rice traders only collect paddy in the countryside for 4-6 months each year, although some smaller traders continue in areas where the roads are good until the heaviest rains come in December. But during the depth of the *soudure*, December-March, farmers must transport paddy to market themselves, so there is a certain seasonality to market integration. Azam *et al.* [1993] conclude that liberalization did not improve interseasonal price patterns. Indeed the data in Table 3 suggest that once one controls for the effects of a seasonal rice buffer stock facility introduced in late 1986 and terminated in 1990, liberalization brought sharp increases in interseasonal price variability.

If one takes the year-specific seasonal indices generated by the ratio-to-moving average method of deseasonalizing the regional real commodity price series for spatial market integration testing, and calculates the maximum/minimum ratio of the monthly indices, an estimate of the average intra-annual price increase emerges. Table 3 presents these estimates for three distinct periods: pre-liberalization (1983-85), the period of rice buffer stock operations (November 1986-March 1990), and the post-liberalization period outside of the buffer stock era. As with the statistics regarding spatial market integration,

the data are separated into the primary and secondary regions on the basis of *ex ante* government control over food marketing channels and the *ex post* condition of supporting infrastructure. The regionally-differentiated effects of buffer stock operations and liberalization on interseasonal price increases are striking, and quite consistent with the findings of urban bias in price risk [Barrett 1995].

If the costs of seasonal storage, including interest, handling and commercial storage losses, are on the order of 20-40 percent, as has been estimated by the World Bank [1991a] and Azam *et al.* [1993], it is clear that most commodities have consistently displayed unusually large interseasonal price increases. In the preliberalization period only beans and rice in the secondary regions had average increases in this range. Interestingly, during the pre-liberalization period the periodic increase in food prices was generally less in the secondary regions, where government controls were less ubiquitous and effective, than in the primary regions around the major metropoli.<sup>19</sup> This situation was quickly reversed with liberalization, however, as the primary regions — which enjoy superior access to credit, all-weather transport, and bulk commercial storage — saw much lower rates of interseasonal price increases.<sup>20</sup> Still, interseasonal price changes lept with liberalization. Of the 57 commodity and region-specific price series in the data set, 50 saw an increase in interseasonal rates, with 27 more than doubling from one period to the next. 25 of the 57 series have averaged seasonal monthly price peaks more than double the monthly minima since liberalization. The most likely reasons for the

sharp rise in interseasonal price ratios are the tightening credit situation, the diminished threat of government price controls, and the reduced role of the state societies, which, unlike most private traders, enjoyed ample bulk storage capacity and credit to maintain interseasonal stocks.

The rice buffer stock facility, introduced explicitly to temper sharp seasonal increases in rice prices that emerged immediately following the most significant food market liberalization measures, seems to have dampened interseasonal margins, particularly in the primary regions, where three-quarters of the price series saw a decrease in seasonal price rises from the pre-liberalization period to the buffer stock period. The evidence is more mixed in the secondary regions where, except for rice, median price rises are lower, but most price series evince greater seasonal price increases in the buffer stock period than prevailed before liberalization. Since the facility operated almost entirely in urban areas (especially Antananarivo and Toamasina, the principal storage sites), it should come as little surprise that the positive effects of buffer stock operations were concentrated in those regions.

The seasonal food price increases in Table 3 are not unusual for Sub-Saharan Africa. For example, Coulter [1994] reports that interseasonal maize price increases in Ghana average 120-170 percent across regional markets. He too emphasizes the weakness of the financial sector as the proximate cause for substantial interseasonal price variability: "a major reason for interseasonal price variability ... is the weakness of the

financial sectors in most African countries. Most countries have embarked on financial reform, ... but this is a slow process which often lags far behind reforms in grain marketing. Moreover, after capital restructuring, bankers are generally conservative and reluctant to lend to cereal traders, most of whom are unknown to them, keep no formal accounts and are considered a poor lending risk" [Coulter 1994, p. 25].

Panseasonal official pricing and government-controlled credit rationing created serious disincentives to the maintenance or expansion of private bulk storage capacity in the pre-liberalization years. The resulting shortfall in storage capacity, and significant concentration in the hands of a very few large trading houses, has created serious problems for intertemporal arbitrage. Moreover, less than half of national commercial stockage capacity is accessible year-round [Fivoarana 1989]; much of it is intended for transactional, as opposed to interseasonal, inventories. Storage losses among big, commercial traders are relatively low, at 1-3 percent annually [Azam *et al.* 1993; my unpublished data]. On-farm loss rates, by contrast, are quite high: 11-26 percent, depending on region, season and technologies employed [MPARA/FAO 1987]. So the lack of interseasonal commercial storage facilities inevitably generates considerable waste due to higher than necessary loss rates. High loss rates, private credit rationing that generates quite high shadow interest rates, and the substantial problems of crop movement when rural market demand peaks during the rainy season all combine to drive exceedingly high interseasonal price variability. Liberalization appears only to have



exacerbated this situation.

## **Conclusions**

The empirical results from Madagascar support the hypothesis of countervailing market relaxation and state compression effects of liberalization measures. Relatedly, this paper demonstrates there are important interregional and seasonal differences in the way price shocks are transmitted within Madagascar's food subsectors. These differences mute substantially the influence central government policy measures have on the incentives faced by rural consumers, producers and marketing intermediaries, an influence presumed in the expectation of a robust supply response to improved prices. These findings are consistent with the broader literature on African agricultural liberalization, which emphasizes the twin necessities of dismantling inefficient and inequitable state restrictions on trade and of improving the density and quality of supporting infrastructure and services, particularly in communications, finance, storage, and transport.

The World Bank [1991a, p.31] sums up its assessment of the generally sluggish response of Malagasy agriculture to liberalization measures thus:

"A major reason which explains the limited supply response from the agricultural sector is the pervasive deficiency of rural markets in Madagascar. Rural market inefficiencies are related to four structural constraints: an inadequate rural infrastructure, inappropriate government intervention and regulation on commodity and input markets, inefficient provision of public services, and deficiencies with the rural financial market."

In a similar spirit, Jayne [1994] points out that while improved crop productivity may have substantial long-run potential, in the medium-run more efficient rural food marketing networks may be more important to stimulating agricultural commercialization and to the evolution of cropping patterns according to comparative advantage. Generally speaking, insufficient attention has been paid to issues surrounding the architecture and functioning of agricultural markets in the design and implementation of policy reform measures aimed at stimulating a strong, sustainable agricultural supply response. In Madagascar, such oversights likely lie at the heart of the poor and uneven performance of the agricultural economy in the wake of liberalization, and in the mixed effects of market-oriented reforms on spatial and intertemporal market integration.

## Endnotes

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1. That is,  $P_{t+1}/P_t = R(1+r)/(1-d)$ , where  $t$  indexes time periods,  $R$  is a risk adjustment coefficient,  $r$  is the real interest rate and  $d$  is the rate of decay of the commodity. While  $d$  is strictly nonnegative,  $r$  is unrestricted. Indeed, achieving positive real interest rates where financial repression has long made them negative has been an explicit objective of monetary reforms in African adjustment programs.  $R$  is also unrestricted since the risks of speculative storage may be either negatively or positively correlated with the stochastic returns to other assets [Chavas 1988].

2. Ghana is the obvious example. More than half the World Bank's disbursements in the initial 1983-1986 period of structural adjustment (\$192 million) went toward rehabilitation of infrastructure and services distribution systems, notably roads, ports, telecommunications, the power grid and water supply [Mosley, Harrigan and Toye 1991]. At the same time, the government began rolling back its interventions in crop marketing, which had been relatively mild, by African standards, for food crops [Coulter 1994]. The reasonably robust response of Ghanaian agricultural productivity and supply [Barrett and Carter forthcoming] and relatively efficient linkages among its domestic agricultural markets [Alderman 1993] likely follow in part from this parallel pursuit of improved infrastructure and governance.

3. By Lipton's definition [1991, p.27], "market relaxation is the removal of restraints upon movement of relative prices, quantities, and qualities of commodities and factors exchanged towards levels that clear the markets." One should acknowledge, as Lipton does, that the case for market relaxation is not new. Among others, Myrdal [1968] focused heavily on this theme.

4. Lipton [1991] suggests that this bias was initially due to extreme neoliberal ideology but since the latter 1980s, and more durably, is due to protracted fiscal crises in reforming economies.

5. Klitgaard [1989] labels this phenomenon "incentive myopia" in his vivid description of the perversities of economic reform efforts in Equatorial Guinea.

6. Of course, parastatals themselves have often been able to renege on contracts without penalty. Delivery of promissory notes — payable only many months later in a highly inflationary environment — instead of cash is but one too-common example.

7. Lipton [1991, p.27] puts it more colorfully: "Just as there is no free lunch, so there is no free market; markets are expensive. Agricultural risk and information are so structured that growing state involvement is usually a prerequisite of effective [market relaxation]."

8. Some studies [e.g., Pryor 1988, 1990] include Antsiranana and Toliary in the urban group since they are among the largest population centers. For present purposes, however, they are excluded because they were never well integrated into the national distribution network. Indeed, neglect of the far south (Toliary) and the far north (Antsiranana) has been a cornerstone of regional political opposition, most notably by the Toliary-based MONIMA party.

9. The data are thoroughly discussed in Barrett [1994b].

10. Specifically, monthly real observations are divided by a twelve-month centered moving average, in order to remove common trend and cyclical components in the data. The year-specific monthly seasonals were then averaged to estimate a seasonal index (*i.e.*, all the January specific seasonals were averaged to generate the January index).

11. More general cross-correlation functions were also estimated to establish whether contemporaneous correlations understate linkages that might be delayed due to contracts, imperfect information flow or delivery lags. A cross-correlation function provides a dynamic generalization of the simple (contemporaneous) correlation coefficient (*i.e.*,  $k=0$ ). The basic form is:

$$r_{p_1 p_2}(k) = [V(p_1) V(p_2)]^{-\frac{1}{2}} c_{p_1 p_2}(k)$$

$$\text{where } c_{p_1 p_2}(k) = \begin{cases} N^{-1} \sum_{t=1}^{N-k} (p_{1t} - \mu_1)(p_{2t+k} - \mu_2), & k \geq 0, \\ N^{-1} \sum_{t=1+k}^N (p_{1t} - \mu_1)(p_{2t-k} - \mu_2), & k < 0 \end{cases}$$

$\mu_i$  is the mean of series  $i$   
 $V(p_i)$  is the variance of series  $i$

The cross-correlation results generally support the contemporaneous correlation specification employed here.

12. These are the six regions mentioned above as well as one (Itasy, immediately west of Antananarivo) that has benefitted from a bevy of infrastructural projects over the past 6-8 years [FAO/IFAD 1991; UNDP/MEP 1991].

13. Above this level variation in one price explains half or more of the variation in the other.

14. This paragraph draws heavily on Rabenarivo [1992].

15. The paragraphs on rural roads draw heavily from Barrett [1994a].

16. As well as the oligopolistic organization of distribution.

17. Although there is no supporting data, these claims are widespread [Abt Associates 1991; Deveze 1990; FAO/IFAD 1991; Hewitt 1992]. Much of this is likely attributable to the stress of prolonged recession, but reduced real expenditures on policing, especially in rural zones, has no doubt facilitated the growing problem.

18. When discussing road conditions, a surprising number of local officials invoke the words of the early nineteenth century Merina king, Radama I: "If I make roads, the white man will only come and take my country. I have two allies: forest (*hazo*) and fever (*tazo*)." The enemies may have changed, but the strategy remains.

19. This reinforces Harriss' [1979a] claim that parastatal food marketing tends to amplify rather than dampen seasonal price variability.

20. The one exception to this is maize, for which there is only one secondary region observation.

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**Table 1**  
**Proportions of Correlation Coefficients (in levels)**

(percent) Commodity	Minimally Integrated <sup>a</sup>		Structural Change <sup>b</sup>		Reasonably Well Integrated <sup>c</sup>	
	pre-lib	post-lib	positive	negative	pre-lib	post-lib
<i>Within primary regions<sup>d</sup></i>						
Dried beans	40	100	60	0	20	70
Maize	40	100	20	0	0	40
Manioc	7	53	33	0	0	13
Potatoes	30	100	60	10	0	30
Rice	76	100	38	0	14	95
<i>Between primary and secondary regions</i>						
Dried beans	30	83	23	3	3	20
Maize	40	100	0	0	0	0
Manioc	24	83	24	0	0	12
Potatoes	8	83	60	0	0	40
Rice	70	91	26	4	19	46
<i>Within secondary regions<sup>e</sup></i>						
Dried beans	47	47	13	27	0	7
Maize <sup>f</sup>	--	--	--	--	--	--
Manioc	24	33	14	10	0	10
Potatoes	10	70	50	0	0	10
Rice	67	89	22	11	7	13

<sup>a</sup>  $H_0: \rho=0$  rejected in favor of positive one-sided alternative at the 5 percent or lower significance level.

<sup>b</sup>  $H_0: \rho_{pre} = \rho_{post}$  rejected in favor of a two-sided alternative at the 5 percent or lower significance level.

<sup>c</sup> Sample  $r > .70$ .

<sup>d</sup> Ambatondrazaka, Fianarantsoa, Imerina Centrale, Itasy, Mahajanga, Toamasina, Vakinankaratra.

<sup>e</sup> Antalaha, Antsiranana, Antsohihy, Farafangana, Fenerive Est, Maintirano, Mananjary, Morondava, Taolagnaro, Toliary.

<sup>f</sup> Maize data are available for only one secondary region.

**Table 2**  
**Proportions of Correlation Coefficients (in first differences)**

(percent) Commodity	Minimally Integrated <sup>a</sup>		Structural Change <sup>b</sup>		Reasonably Well Integrated <sup>c</sup>	
	pre-lib	post-lib	positive	negative	pre-lib	post-lib
<i>Within primary regions<sup>d</sup></i>						
Dried beans	0	40	0	0	0	0
Maize	0	30	10	0	0	0
Manioc	7	33	13	0	0	0
Potatoes	0	20	0	0	0	0
Rice	14	67	19	0	0	0
<i>Between primary and secondary regions</i>						
Dried beans	13	17	30	30	0	0
Maize	0	0	0	0	0	0
Manioc	5	24	7	2	0	0
Potatoes	4	0	8	0	0	0
Rice	10	33	7	1	0	0
<i>Within secondary regions<sup>d</sup></i>						
Dried beans	13	7	0	0	0	0
Maize <sup>e</sup>	--	--	--	--	--	--
Manioc	19	19	5	10	0	0
Potatoes	10	0	0	10	0	0
Rice	9	9	0	0	0	0

<sup>a</sup>  $H_0: \rho=0$  rejected in favor of positive one-sided alternative at the 5 percent or lower significance level.

<sup>b</sup>  $H_0: \rho_{pre} = \rho_{post}$  rejected in favor of a two-sided alternative at the 5 percent or lower significance level.

<sup>c</sup> Sample  $r > .70$ .

<sup>d</sup> See Table 1 for list of regions.

<sup>e</sup> Maize data are available for only one secondary region.

**Table 3**  
**Average Intra-annual Price Changes**  
**(maximum/minimum monthly indices, by period)**

<i>(percent)</i> <i>Commodity</i>	<i>Pre-liberalization<sup>a</sup></i> <i>median</i>	<i>Buffer stock period<sup>b</sup></i> <i>median % decreasing<sup>d</sup></i>		<i>Post-liberalization<sup>c</sup></i> <i>median % decreasing<sup>d</sup></i>	
<i>Primary regions<sup>e</sup></i>					
<i>Dried beans</i>	42.9	19.9	100	51.0	0
<i>Maize</i>	82.4	57.1	60	137.2	20
<i>Manioc</i>	59.2	75.9	50	103.9	17
<i>Potatoes</i>	65.0	22.7	80	81.0	40
<i>Rice</i>	47.1	37.7	86	94.6	0
<i>Secondary regions<sup>e</sup></i>					
<i>Dried beans</i>	28.8	27.1	50	69.5	0
<i>Maize<sup>e</sup></i>	67.2	32.5	100	60.6	100
<i>Manioc</i>	106.3	70.2	57	158.9	14
<i>Potatoes</i>	46.7	44.3	40	102.7	20
<i>Rice</i>	38.9	40.0	40	119.6	0

<sup>a</sup> Jan 1983-Dec 1985.

<sup>b</sup> Nov 1986-Mar 1990.

<sup>c</sup> Jan-Oct 1986, Apr 1990-Dec 1991.

<sup>d</sup> Relative to the pre-liberalization period.

<sup>e</sup> See Table 1.